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**United States Patent** [19][11] **Patent Number:** **5,170,430**

Schuh

[45] **Date of Patent:** **Dec. 8, 1992****[54] VOICE-SWITCHED HANDSET RECEIVE AMPLIFIER****[76] Inventor:** Peter O. Schuh, 121 Forest Knoll Ln., Fishers, Ind. 46038**[21] Appl. No.:** 637,656**[22] Filed:** Jan. 4, 1991**[51] Int. Cl.<sup>5</sup> .....** H04M 1/60**[52] U.S. Cl. ....** 379/389; 379/395; 379/390**[58] Field of Search .....** 379/387, 395, 388, 389, 379/390**[56] References Cited****U.S. PATENT DOCUMENTS**

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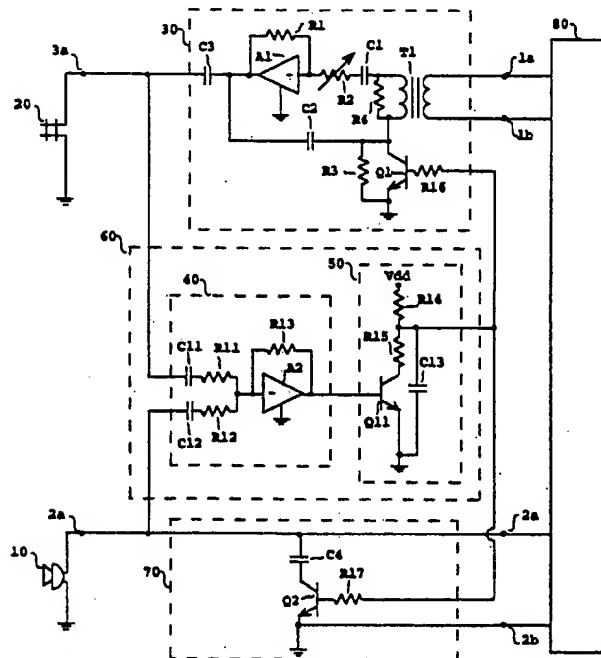
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*Primary Examiner*—James L. Dwyer*Assistant Examiner*—M. Shehata**[57] ABSTRACT**

A voice-band receive amplifier for telephone handsets that mitigates loud sidetone and acoustic sing. A receive channel (30) with amplification and voice-switched attenuation is disposed between a receive port of a telephone network (80) at terminals (1a), (1b), and an electro-acoustic receiver (20). A transmit channel (70) having voice-switched attenuation that varies inversely with the receive channel attenuation is disposed between a transmit port of the telephone network at terminals (2a), (2b), and an acousto-electrical microphone (10). A controller (60) with an output lead connecting to the transmit and receive channels has an input lead connecting to the microphone, and an input lead connecting to the receiver. The controller provides a varying DC control signal at its output lead in response to varying levels of transmit and receive signals appearing at the input of the controller. Receive signals are attenuated when transmit levels are at or above a predetermined threshold. The receive channel is also attenuated when receive levels are at or above a predetermined receive threshold, providing compression of high receive levels. The attenuation in each channel is characterized by having more attenuation at high-end voice-band frequencies than at lower frequencies.

**7 Claims, 1 Drawing Sheet**

US-PAT-NO: 5170430

DOCUMENT-IDENTIFIER: US 5170430 A

TITLE: Voice-switched handset receive amplifier

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Abstract Text - ABTX (1):

A voice-band receive amplifier for telephone handsets that mitigates loud sidetone and acoustic sing. A receive channel (30) with amplification and voice-switched attenuation is disposed between a receive port of a telephone network (80) at terminals (1a), (1b), and an electro-acoustic receiver (20). A transmit channel (70) having voice-switched attenuation that varies inversely with the receive channel attenuation is disposed between a transmit port of the telephone network at terminals (2a), (2b), and an acousto-electrical microphone (10). A controller (60) with an output lead connecting to the transmit and receive channels has an input lead connecting to the microphone, and an input lead connecting to the receiver. The controller provides a varying DC control signal at its output lead in response to varying levels of transmit and receive signals appearing at the input of the controller. Receive signals are attenuated when transmit levels are at or above a predetermined threshold. The receive channel is also attenuated when receive levels are at or above a predetermined receive threshold, providing compression of high receive levels. The attenuation in each channel is characterized by having more attenuation at high-end voice-band frequencies than at lower frequencies.

Application Filing Date - AD (1):

19910104

Brief Summary Text - BSTX (8):

The well-known, half-duplex technology of voice-switching complementary gains in transmit and receive channels has been used over the years in free-air speakerphone applications to avoid sing. However, in an application where the receiver is close to the ear, as is the case with a handset, voice switching sounds unnatural and distracting because the handset user hears "pumping" of both sidetone and incoming receive levels when the receive channel makes gain transitions. Full-duplex technology, such as with adaptive echo-cancellation, can mitigate these problems, but has the disadvantage of complexity and high costs.

Brief Summary Text - BSTX (13):

The invention achieves the above stated and additional objects by combining in a handset having a transmit channel, a receive channel, a microphone and a receiver: an amplifier disposed in the receive channel with first and second negative feedback loops; a manually operated volume control working in relation with the first feedback loop; two variable impedances, one disposed in the transmit channel and the other disposed in the second feedback loop; and a controller circuit which controls the variable impedances to concurrently modify the gain/attenuation of each channel in response to varying levels of voice signals in the transmit and receive channels. The variable impedances

are imbedded within their respective channels such that the receive and transmit channels experience voice-switched attenuation varying inversely relative to one another. When receive and transmit levels are below predetermined thresholds, the transmit channel is attenuated while the receive channel gain varies from unity to its maximum under control of the manual volume control. When the transmit level reaches its threshold, loss in the transmit channel is switched out and a corresponding amount of loss is switched into the receive channel. When the output of the receive channel tries to exceed its threshold level, output receive levels are compressed by automatic gain control (AGC) action. A feature of the invention is that more loss is switched at upper voice-band frequencies than at lower frequencies. An additional feature is that the amount of gain switched is proportional to the amount of gain added by the volume control.

Claims Text - CLTX (11):

said receive channel means further including a receive attenuation means for providing variable, frequency-dependent attenuation to the receive signals to inverse relationship with said transmit attenuation means, in response to said same changes in said control signal;